

REMARKS

Claims 1-28 and 30-32 are pending in the application. Claims 22-28 and 30-32 are rejected. Applications gratefully acknowledge the Examiner's indication that claims 1-21 are allowed.

By the above amendment, claims 22, 23 and 26 are amended. Reconsideration of the rejections is requested.

Claim Rejections - 35 U.S.C. §102

Claims 22-28 and 30-32 are rejected as being anticipated by U.S. Patent No. 5,052,481 to Horvath. Applicants respectfully assert that at the very least, the subject matters of claims 22 and 26 are patentably distinct and patentable over Horvath for those reasons previously asserted by Applicants.

In particular, Applicants respectfully disagree with the legal and factual basis for the rejection of claim 22. Indeed, Although Horvath arguably teaches thermal joints formed by interdigitated thermal fins positioned between each chip and a cooling hat, FIGs. 3A, 3D and FIG. 2 of Horvath make is perfectly clear that every thermal joint is oriented such that *every and all* of the interdigitated thermal fins (14, 43) extend in the same exact direction across the package substrate, and are not oriented to extend in a direction that passes through a neutral stress point of the semiconductor package. In particular, FIG. 2 of Horvath illustrates a plurality of chips (11) mounted on a substrate (10), wherein a cooling hat (40) has continuous channels formed therein providing thermal fins that extend in the same direction over the entire cooling hat (40). In this regard, the "thermal fins" for all chips (11) would extend in the same direction, and thus, the thermal joints of every chip would not have thermal fins extending in a direction that passes through a neutral stress point of the semiconductor package.

On page 3 of the Office Action, the Examiner finds that the limitations of claim 22 are met by Horvath's teachings that a single fin (40) above item 36 extends downward from a vertical plane that passes the middle of the chip (11). Applicants respectfully submit, however, that this characterization of Horvath does not support a finding that the thermal joints are orientated such that the band of thermal fins extend through a neutral stress point of a package for the simple fact that the neutral stress point of the semiconductor package is very much different from the middle of a chip mounted on the package substrate.

Notwithstanding the above, in the interest of cooperation, Applicants have amended claim 22 for the sole purpose to clarify the differences of the claimed subject matter and Horvath. Claim 22 recites, in part, *wherein each thermal joint connection is disposed such that each corresponding band of thermal fins is orientated to extend in a direction towards a common point of the package substrate, the common point corresponding to a neutral stress point of the semiconductor package, and such that the corresponding band of thermal fins for two or more thermal joint connections are orientated to extend in non-parallel directions towards said common point.*

For ease of understanding of the subject matter of claim 22, the Examiner may refer to the exemplary embodiment of FIG. 7, which shows that the thermal joints of each chip (71~79) mounted on the package substrate (70) has its corresponding band of thermal fins orientated in a direction extending through a common point C of the substrate (see description on pages 40-41 of Spec.), and where the band of thermal fins for at least chips 73, 74 and 75, for example, are orientated to extend in non-parallel directions towards the common point C.

Horvath clearly does not teach such an arrangement. Indeed, as noted above, FIG. 2 of Horvath makes it clear that the band of interdigitated thermal fins (formed by finned thermal

device (14) positioned over each chip (11) and the fins (43) of the cooling hat (40)) between each chip (11) and the cooling hat are all orientated in the same exact direction over the substrate (10). For at least the above reasons, claim 22 and corresponding dependent claims are patentable over Horvath.

Furthermore, with regard to claim 26, the Examiner has not yet addressed nor explained how Horvath teaches the specific claim limitations of claim 26. For example, the Examiner has not shown how or where Horvath teaches *the thermal joint further comprises a compliant thermal conductive material formed between planar portions of the non-active surface of the semiconductor chip and the mating surface of the heat conducting device*. Again, Horvath clearly and unambiguously teaches that thermal joints are formed which include bands of interdigitated thermal fins that pass over the entire back surface of the chip, and therefore all points of the chip. In this regard, Horvath does not teach that different types of thermal joints are used between the backside surface of a chip and a heat conducting device to form a thermal joint connection between the chip and the heat conducting device.

Notwithstanding the above, in the interest of cooperation, Applicants have amended claim 26 for the sole purpose to clarify the differences of the claimed subject matter and Horvath. Claim 26 recites, essentially, a thermal joint that is disposed between the non-active surface of a chip and a heat conducting device, *where the thermal joint comprises first and second portions formed between the chip and heat conducting device, wherein the first portion of the thermal joint comprise a band of interdigitated first and second thermal fins, and wherein the second portion, disposed adjacent to the first portion of the thermal joint, comprises a compliant thermal conductive material formed between corresponding planar portions of the non-active surface of the semiconductor chip and the mating surface of the heat conducting device*.

For ease of understanding of the subject matter of claim 26, the Examiner may refer to the exemplary embodiment of FIGs. 8A~8D, for example, which illustrates an apparatus for thermally coupling a chip to a heat conducting device using a thermal joint formed of at least two different types of thermal connections. More specifically, Fig. 8A is a schematic side view of a semiconductor package (80) comprising a thermal connector (83) which thermally couples a heat conducting device (21) to a semiconductor chip (22). Fig. 8B is a schematic side view of a portion of the thermal connector (83) as formed in the exemplary region (R1) of FIG. 8A, wherein the thermal connector (83) comprises a thermal microfin joint having a plurality of interdigitated microfins (21a) and (22a) with a TIM (83) applied therebetween. Fig. 8D is a schematic side view of a portion of the thermal connector (83) as formed in the exemplary region (R2) of FIG. 8A, wherein a layer of TIM (84) is applied between the parallel surfaces of the chip (22) and heat conducting device (21). Horvath does not teach such an arrangement.

Accordingly, for at least the above reasons, claims 22 and 26 and corresponding dependent claims are patentable over Horvath. Accordingly, withdrawal of the anticipation rejections is requested.

Respectfully submitted,


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